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A
PHILOSOPHICAL ESTIMATE
OF THE
CAUSES, EFFECTS, AND CURE,
OF
UNWHOLESOME AIR
IN
LARGE CITIES.

With a new, easy, and effectual Mode of supplying with perpetual warm, or cool fresh Air, Churches, Theatres, Prisons, Hospitals, Ships, Houses, Public, Private, or Sick Rooms, &c.

TO WHICH IS PREFIXED,
A PHILOSOPHICAL DISSERTATION
ON THE CAUSES AND CURE OF
SMOKING CHIMNIES.

Illustrated with Copper-plates.

By A. WALKER,
Lecturer on Experimental Philosophy.

Sold by Mr. ROBSON, Bookfeller, New Bond-Street; Mr. JOHNSON, St. Paul's Church-yard; and the Author, at his Lecture-room. PRICE *Two Shillings.*

M, DCC, LXXVII.



P R E F A C E.

*T*HERE never was perhaps, a period of time when philosophical researches were prosecuted with so general a spirit, as the present: And as the air is that Nidus in which Nature designed us to live, it is much to the credit of our present experimenters, that many who stand high in the list of reputation, have concentrated their abilities and labour upon a subject of such importance to mankind. The Learned of all Europe bear testimony to the utility of Dr. Priestley's discoveries; for his works are translated, and the Mine he has opened, explored and prosecuted by all ranks. The Author of the following estimate however, has small pretensions to enter the list with such veteran Explorists; happy in making their Discoveries more generally known, he presumes at last, with great deference, to add a small matter to their labours.

He

He has often lamented, that among the variety of airs that have been discovered, no one should try to extract from the common air those mixtures and qualities that make it pernicious to breathe. In the course of a great number of experiments, (where the common air was made to pass through various substances to animals confined in close vessels) he has discovered that air may be philtered as well as water; that in its passage it may have its noxious particles separated from the general mass, and be made as pure at least, as the air in general is in the Country.

He considered this as of too much importance to large cities, mines, ships. &c. to postpone its publication, till further discoveries were made; a motive, which he doubts not, will cover a multitude of literary sins, committed in so hasty a production.

Models of the means by which Churches, Theatres, Prisons, Ships, Mines, private Rooms, &c. may be thus ventilated, may be seen at the Author's lecture-room; and directions given to, or work-men provided for, those who chuse to have such ventilation.



DISSERTATION
ON THE
CAUSE AND CURE
OF

Smoking Chimnies.

SINCE the properties of both natural and factitious Airs are become so experimentally known, the world has become proportionally conscious of the Necessity of breathing Air, as little impregnated with Phlogiston, Smoke, or other Matter, as possible.—It is now ascertained beyond a doubt, that one great design of Nature, in letting the Air have so near a Communication with the Blood in the
A Lungs,

Lungs, is, that it may imbibe the superabundant Phlogiston, in that Blood; thereby rendering it thin and florid, and re-qualifying it to make its way through the fine vessels of the body. A Candle will not burn in Air that has been breathed some time, because that Air is phlogisticated, and cannot imbibe the inflammable principle from the Candle.—Fire separates this inflammable principle from Coals, Wood, Metals, &c.—The Air as a Menstruum imbibes it, and becomes less fit to breathe in proportion as it has more of that Phlogiston in it.—Hence maybe conceived the danger of breathing Air impregnated with the Smoke of Coals, Wood, Candles, or any thing that loads it with Phlogiston; for Blood, (perhaps already too thick by high Living) receives additional malignance and Density by breathing such Air; and from hence may be dated many of those Disorders that arise from Obstructions, and that tendency the Body has to putrid Fevers, so little known to those who live more exposed to the wholesome severities of fresh Air.

That

That the Rationale of the following Prescriptions for smoking Chimnies may be better understood, it is necessary to prefix a few Axioms, as Data to the Reasoning on that Subject. *Viz.*

1st. Fire rarifies, or sets the Particles of all Solids and Fluids at a greater distance from one another, than when they are cold.

2d. Air heated, and becoming thinner and lighter by that Heat, is buoyed up by the colder and heavier Air about it, just as a Cork rises from the bottom to the surface of Water.

3d. Steam is also lighter than Air, and therefore rises in it for the same reason.

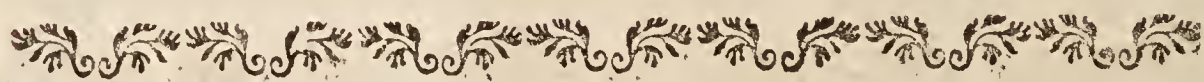
4th. Both Smoke and Steam rise languidly when there is no Motion in the neighbouring Air, because they are very little lighter than Air.

5th. Fire heating the Air in narrow Chimnies makes the Smoke ascend swiftly; because

because the colder and heavier Air from the Room, will rush through a narrow space with great rapidity to balance or restore an equilibrium with the light Air in the Chimney, and will carry the Smoke up swiftly with it; for there is no Draught or Suction in narrow Chimnies, tis the Air in the Room that *drives* Smoke so rapidly up them.

6th. Air in Motion always inclines to-
towards the Space which affords it the least
resistance.

These things premised, the general
cause of Smoking Chimnies will easily be
perceived to arise from *a too great width at
the Bottom; a Wind at Top; the Heat and
Cold of neighbouring Rooms, or the too great
closeness of their Doors and Windows.*



On Kitchen Chimnies.

Kitchen Chimnies are most subject to
the first Malady, from the width required
for

for Pans, Spits, Stoves, &c.—Smoke rises in a wide bottom'd Chimney by its own specific lightness; the Air of the Room assists its rise very little, as it moves thro' too wide a Space to go swift; hence the least puff of Wind over a neighbouring Tree or House (that is higher than the Chimney as fig. 4.) stops the Ascent of the Smoke, and it oozes into the Room by sudden bursts, or a regular flow under the Chimney Piece.—A Smoke Jack sometimes cures wide Chimnies, by contracting their width, and thereby obliging the Air and Smoke from below, to rush thro' with such a momentum, as to be more forcible than the Winds that blow from above. Indeed a Contraction about six Feet above a Kitchen Fire (as fig. 9.) generally cures the Chimney if it be as *high* as the neighbouring Houses; but if it be *lower*, the unhappiness must be cured at Top, by something that will prevent the eddy Winds from blowing down the Pipe. I have never found any thing prevent the Effects of eddy, reverberating, or downward Winds, so effectually as a Pyramid made of Shelves sloping outward, about three Inches asunder.

The

The Base of this Pyramid should be the same Size as the Top of the Chimney, and end in a Point over the Center of it, about two Feet above the Top. It is represented in fig. 8th.

But if the Chimney be very low, or Houses, Hills or Trees much above it, the *double Pyramid of Shelves*, as fig. 7th. is more effectual.—It is slid across the Chimney Top, and fastens easily to the Wall; its Bottom is open, to conform to the Chimney Pipe and become a Part of it; the Board *e* (covering the Pipe) prevents an Eddy Wind going immediately down the Chimney; and if it even gets thro' the Shelves it goes thro' the *open side Pipes* a without entering the Chimney. This Contrivance being generally of Wood, is apt to take Fire, if it be not made of Poplar Boards or Sheet Iron.

This Device is very applicable to a Chimney situated as *o*, fig. 4. where a Wind coming from *E*, eddies over the Steeple, and blows right down the Chimney,

ney, driving the Smoke before it into the Room below.—It is equally efficacious when the Wind coming from the W, reverberates from the Steeple, and curls as it were down the Chimney o; for a Wind *against* is equally as bad as one *over* an higher Object.—Low Chimnies are always more liable to Smoke than higher ones; because the light rarified Column of Air within them, is a less portion of the height of the Atmosphere, than in an higher Chimney, and therefore the Smoke rises more languidly, and is more subject to be drove down by eddy or bosoming Winds.



Of Chimnies that smoke with particular Winds.

This Malady is generally occasioned by the Chimney Top being *lower* than some neighbouring House, Tree, Church, Hill, or Rock; for Winds or Currents of Air, always lean towards any Shelter or Place that affords the *least* Resistance: Hence in
coming

coming over a Steeple as fig. iv, it *bends* to leeward of the Steeple as at o, and pours straight down the Chimney below it: or when the Wind comes in a contrary Direction as from W, then it blows against the Steeple, &c. curls into various Eddies, and pours every now and then down the adjoining Chimney.—In both cases the Smoke comes into the Room in large Puffs at Intervals.

Chimnies that are *streight*, and wider at *Bottom* than the *Top*, as c o fig. 4th, suffer most by such a Situation: For as it is the Air in the Room that drives the Smoke up a Chimney—the Smoke must rise more languidly in *wide* than *narrow* Chimnies, and of course be more easily beat down by Winds at Top: Hence Kitchen Chimnies are more liable to smoke than others, because of that width at Bottom so necessary for Pots, Pans, Stoves, &c. and Contractions being quite inconvenient, the Air goes up them too slow to be a match for an eddy Wind. Smoke Jacks do great Service to those Chimnies, by the Contraction they occasion; for they both stop the Eddy
Wind

Wind, and the Smoke rushes by the Jack with too much rapidity to be easily beat back.—Hence contractions in a Kitchen Chimney, about the usual height where smoke Jacks are placed, sometimes does much service, as fig. 9th; particularly when the contrivance fig. vii, is placed at top.—These contractions may be any thickness of Brick-work, leaving the *opening* for the Smoke to go up, about seven Inches square.

The Contrivance of Tin (fig. 11th) is well calculated to prevent the effects of eddy or horizontal Winds.—The Pipe *a e* is bricked up when stuck into the Chimney-top, and has a strong stay across its top at *e*, as a support to the upright spindle *e d*: The bent Tube *s s q e n* slides freely over the Pipe *a e* at *s s*, and having a socket of tin well folder'd to the top at *d*, the socket receives the upright pin *e d*, and the whole easily turns round when the wind influences the Vane *o*, turning the open part *a* always from the wind, so the smoke comes into the air without obstruction.



*On Chimnies that Smoke with horizontal
Winds.*

In level Countries, where tall trees or other towering objects do not occasion *eddy* winds, a piece of sheet Lead, as n n n n fig. 6th, may be made into an useful protection from the effects of *horizontal* Winds—make scratches a a a a—then cut thro' the lead the crossing lines e e e e—and bend each piece up at the pop lines nearly perpendicular to the rest of the lead, so that it may be like e e e e fig. 5th.—The square hole thus made must be the size of the Chimney pipe—so that when placed on the top of the Chimney, it may bend over it at the scratches a a a a, and fasten to its sides by the pins n n, fig. 5th.

This simple cap to the chimney has its effect, by diverting the horizontal current of air into eddies round its sides and points,
—by

—by which the wind is prevented from going with any force downwards, and of course from giving much obstruction to the rising smoke.



Bath and Patent Stoves.

The Bath Stove fig. 3, is a most effectual means of preventing smoky rooms, by the draught it occasions—its narrowness obliges the air in the room to rush thro' the Fire; and by the rarification it receives there, it forces its way up the chimney, with such velocity, that eddy winds are over-powered by its current.—Most Grates that are called Bath Stoves, are but *half* Bath Stoves, not having the inclosures a a; —so that the wideness of such fire places allow the air of the room to go up the chimney in too languid and cold a current to drive up the smoke with sufficient force against eddy winds.—But such fire places

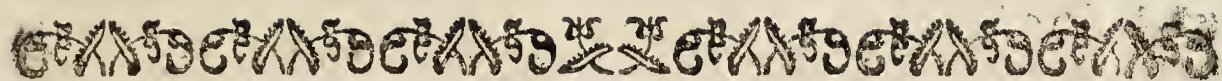
as these are easily made into Bath stoves by two flag stones shaped as a a fig. 3d, on which may be cut ornaments similar to those of the cast-iron of the lower part;—which stones, when rubbed over with a little powdered black lead mixed in the white of an egg, will not be distinguished from the iron part of the stove, but look as if the whole was of that metal.—The great draft occasioned by this stove makes a greater consumption of coals; but prevents smoky rooms in every case, but where there is a *neighbouring* fire of *greater* heat than that in the stove.—This is the most incurable Disorder incident to chimneys.—For instance, when a sitting parlour is in the neighbourhood of a Kitchen where there is constantly a larger fire.—whenever a Door opens that makes a communication between the rooms, down comes the smoke straight into the Parlour!—for the heat of the Kitchen fire makes the air rush towards it in all directions, and air coming down the parlour chimney into the kitchen, brings all the smoke along with it.—Hence also when two fires are in one room,

room, if not kept both of an equal heat, the *cooler* will smoke into the room by the air rushing down its chimney to restore an equilibrium with the *hotter* fire.—Neighbouring rooms, with fires in, are liable to the same malady, if the doors of communication between them be not constantly shut, or a sufficient quantity of air be not let into such rooms by other means.—A very effectual cure for this, is by the *patent Stove* fig. 12th—this is a square box of iron going about a Yard up the Chimney, having a Door d n that exactly fits it—this door turns on hinges as at d, and is lifted up or let down by a Register s o—this register when screwed *into* the chimney by its crank Handle, lets the door down, and reduces the Chimney to any degree of narrowness that may be wanted, either to increase a draught, prevent the falling of soot, or to reflect a strong heat into the room from live coals; but when a draft is not wanted, the register may be screwed *out* of the chimney, and the door d n will then be open.—Hence in particular winds the draught may be so increased as to overcome them

them—and the chimney may be entirely shut, so as to prevent any air coming down when a neighbouring fire shall affect it as above; or when smoke from a neighbouring chimney may be blown down it.

For rooms without a fire are often filled with smoke and soot, by the air coming down their chimnies, and bringing smoke from neighbouring chimnies along with it.—Hence in Summer when rooms are generally without a fire—the air of the Atmosphere is hotter (when the Sun is up) than the air within doors; so that if the flame of a candle be held in a chimney, a current of air will be found to rise out of the room *up* the chimney: but at night the air of the Atmosphere will become colder and heavier than the air in the room, and then the flame will be found to *descend* into the room;—so that if a neighbouring chimney be smoking, a portion of that smoke will be brought down by the above current of air: the door of the patent stove (shut) prevents this.

The



The Urn Stove.

The most effectual and elegant mode of warming a large Room, is by means of an *Urn Stove* placed in the middle of it—the Plan of this Stove is taken from Dr. Franklin's american Stove; its *Shape* being all that is new. It may be seen on a large scale in the magnificent Rotunda of the Bank of England, and its principles may be conceived from fig. 13th.—g g is an hollow Urn of cast iron;—n n the level of the room Floor;—c, a small opening in the urn for the fire-place;—a, the Grate; o, a thin iron partition in the Urn, but not reaching to its top.

When a fire is made at c, the smoke and heat naturally ascends to the top of the Urn; there it turns over the top of the partition o, and descends to e, where under

der the floor n; an iron pipe conveys it to the Wall of the room, up which it ascends a chimney in the usual way. The fire ascending to the top of the Urn, heats it all over, nearly, and sometimes red hot. The iron thence heats the Air all round, much more effectually than when the fire is on one side or in a corner of the room; but all metals heated, emit a *Phlogiston*, of which the air is a natural Menstruum.—I therefore humbly conceive, that the *air* of all rooms, heated even by iron stoves, is much contaminated; tho' iron dissolved by either air or water, is less pernicious to the human constitution than any other metal; yet *chalybeat Air* is certainly more pernicious to the *Lungs*, than *chalybeat Water* is to the *Stomach*.



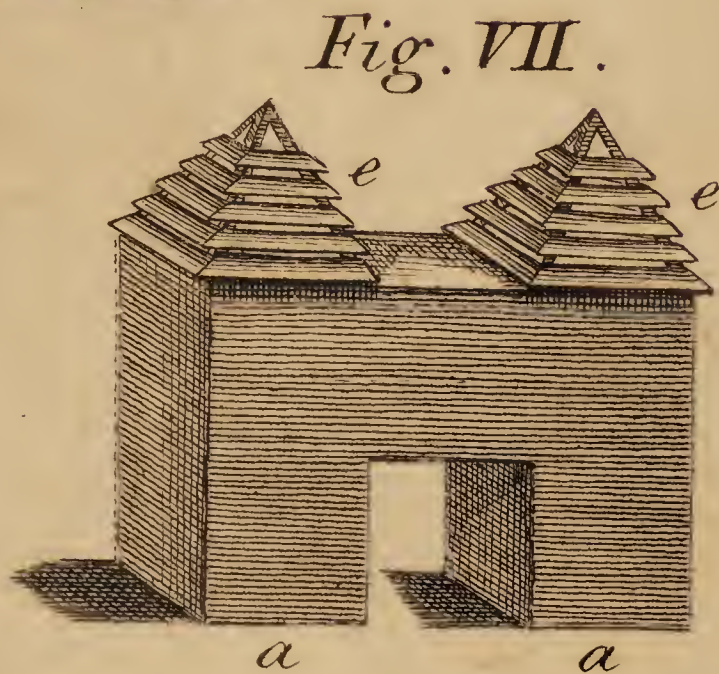
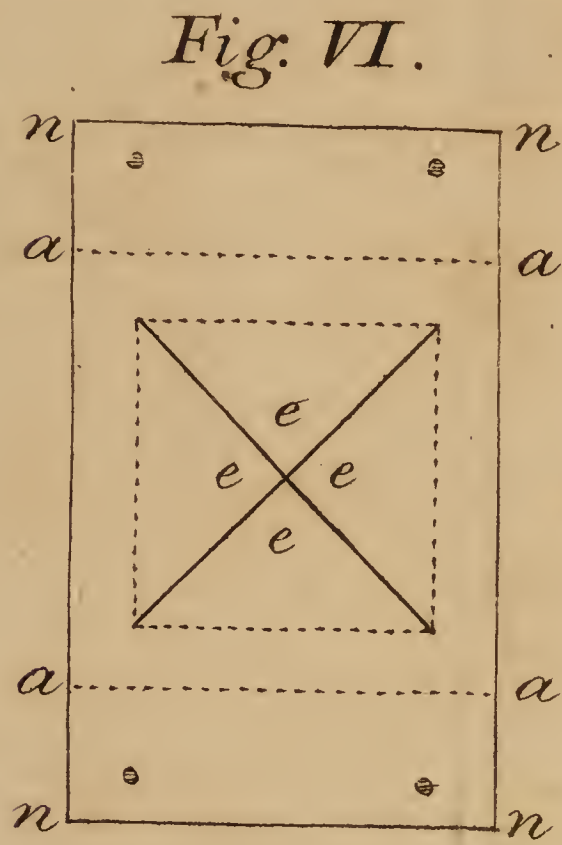
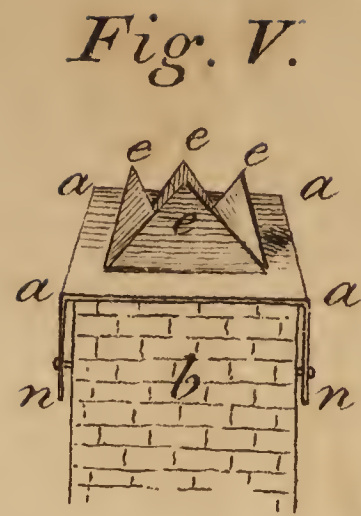
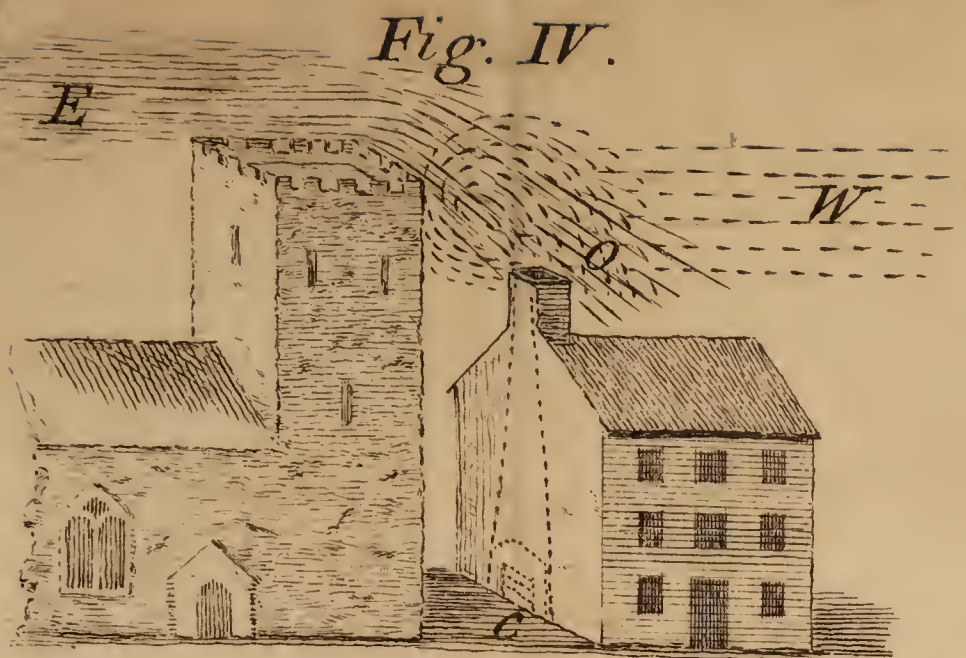


Fig. IX.

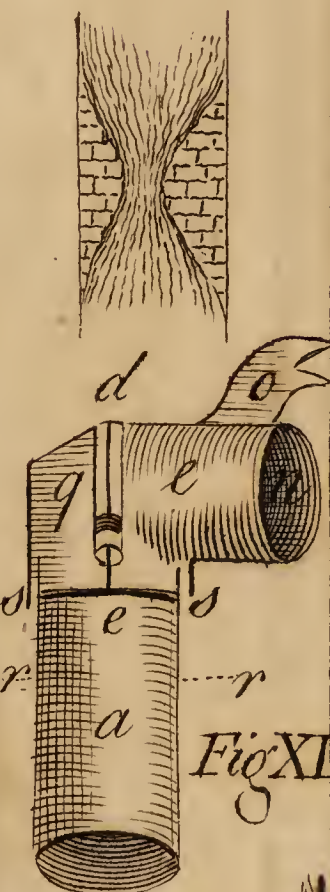


Fig. VIII.

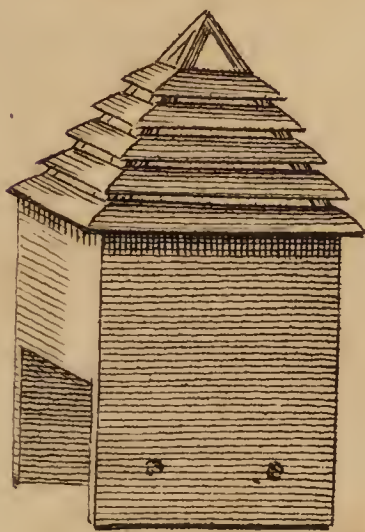
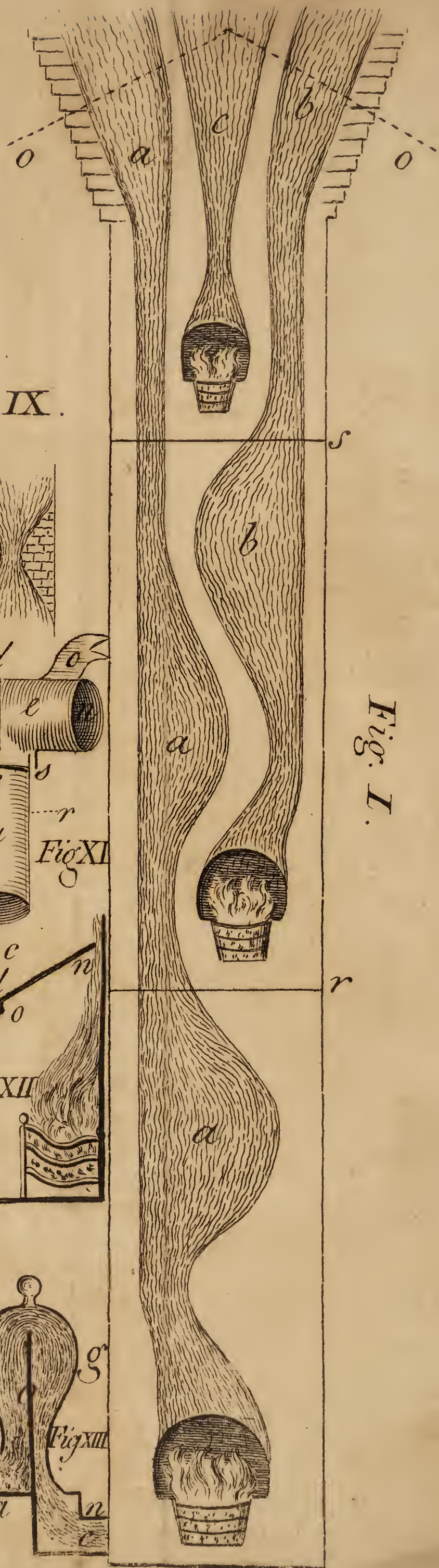
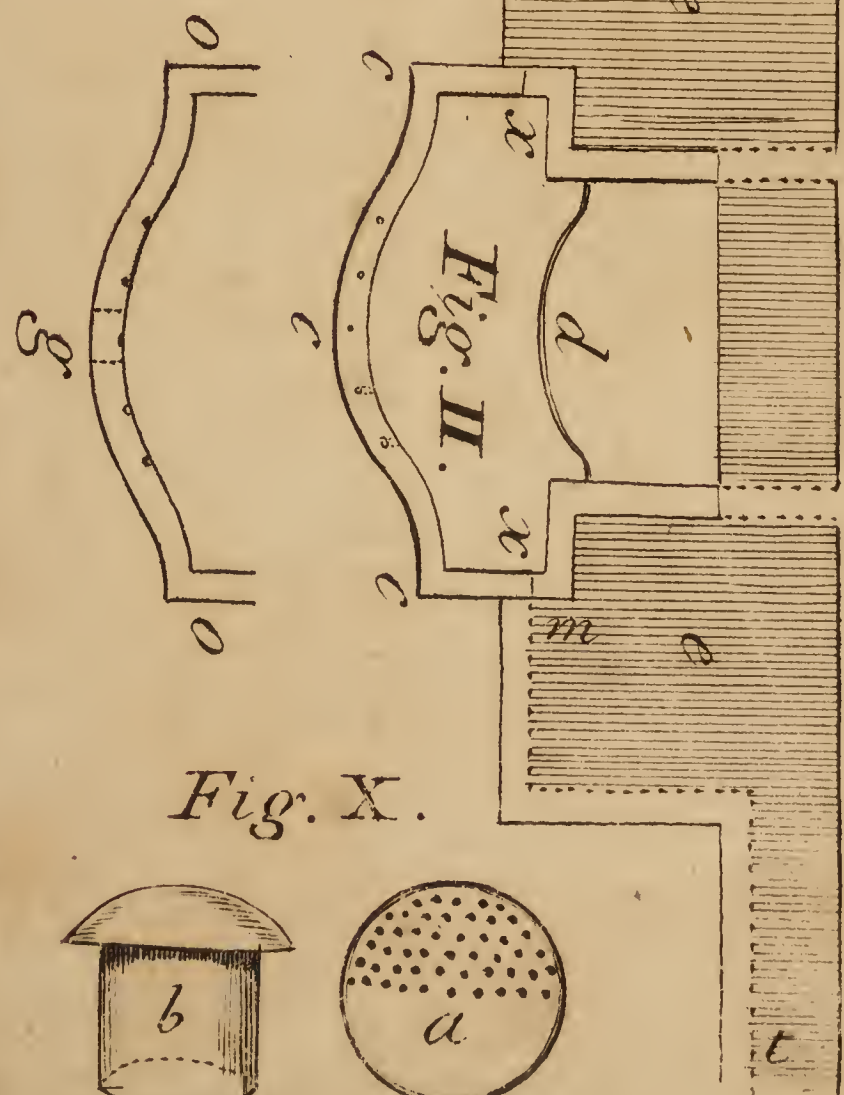
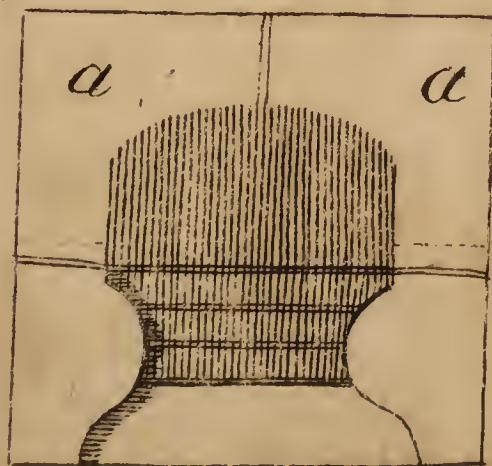


Fig. III.



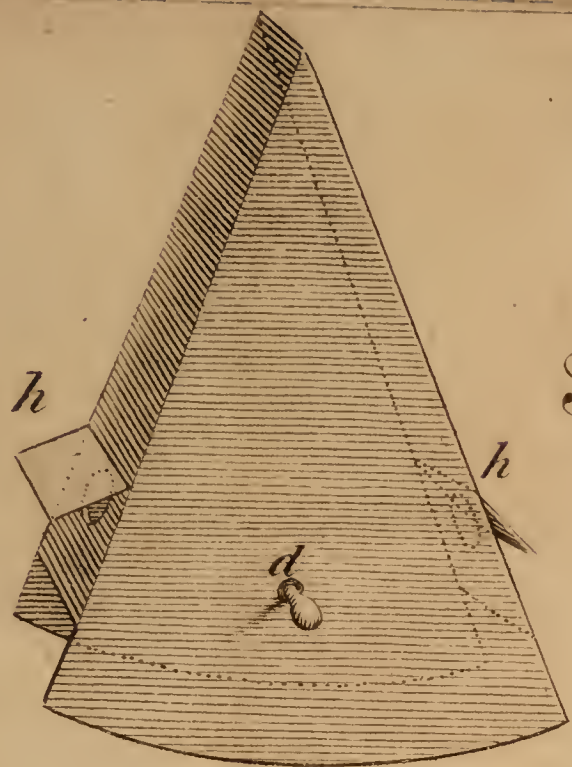


Fig. 5th



Fig. 7th

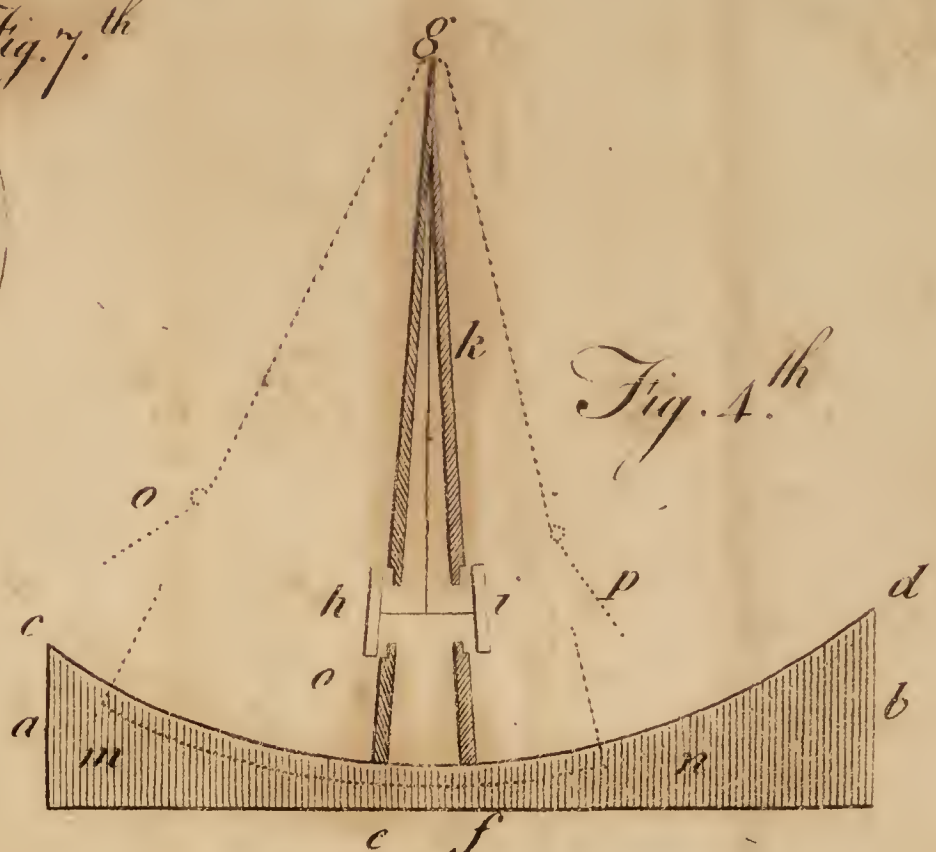


Fig. 4th

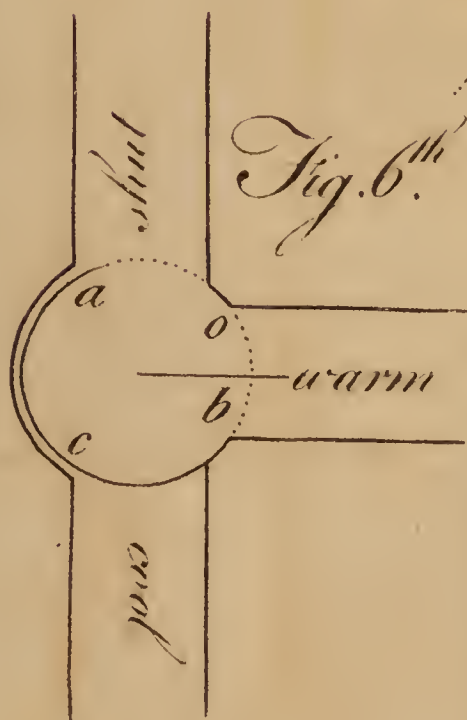


Fig. 6th

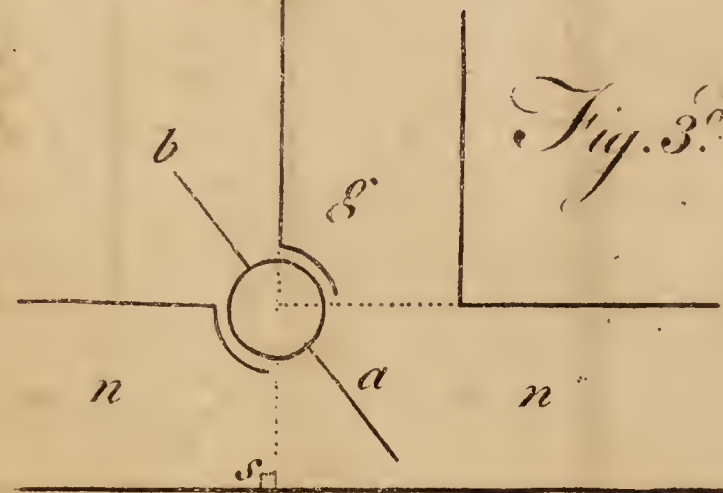


Fig. 3rd

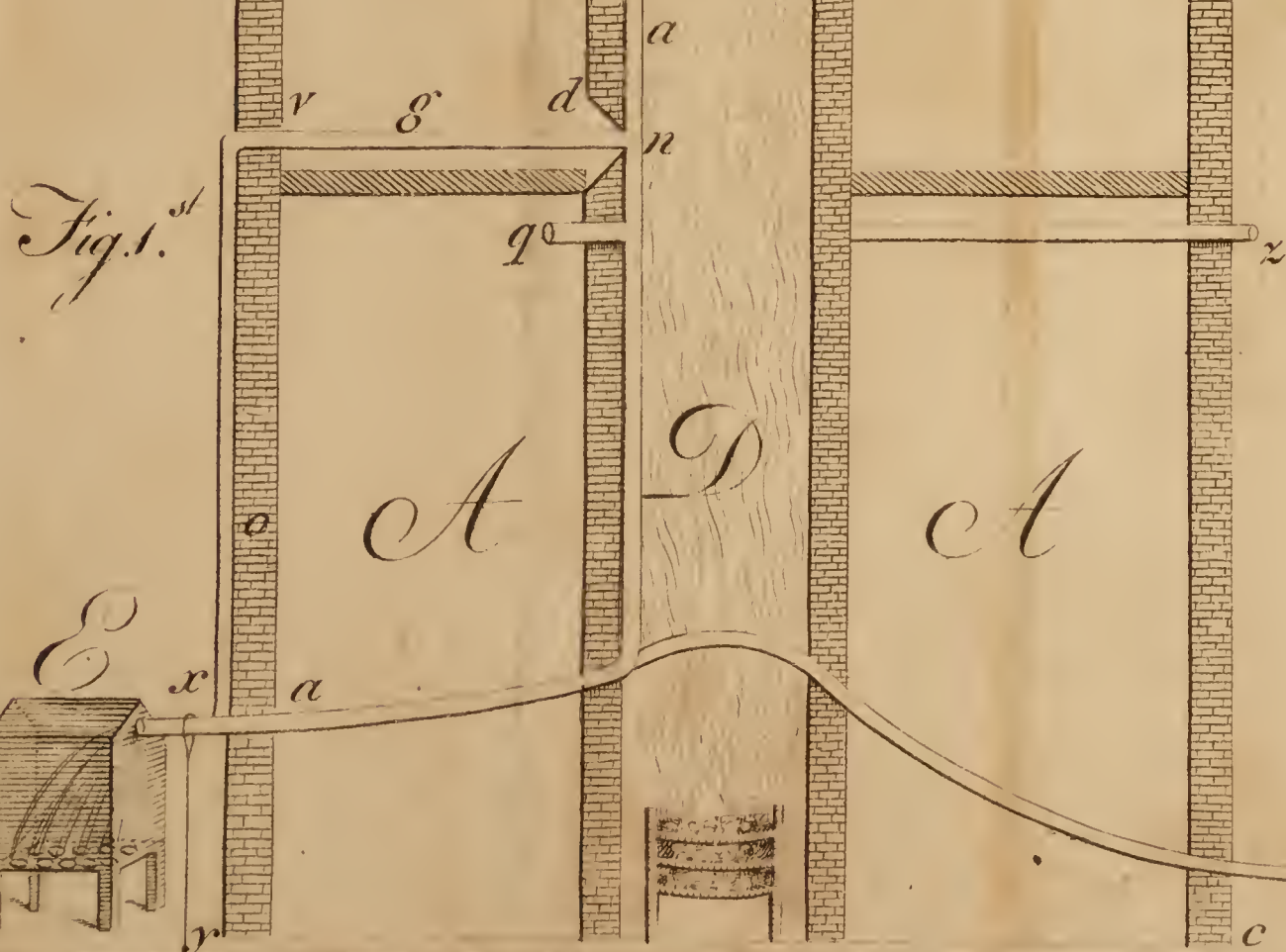


Fig. 1st



Fig. 2nd





A New Method of curing Smoking Chimnies.

TH O' many of the foregoing methods of cure are very effectual, and when properly apply'd even infallible; yet situations and local circumstances are so various, that few apply them properly. For, as one Medicine will not cure all the disorders of the human body—nor can a cure be expected even from a proper Medicine when improperly apply'd to any particular disorder; so chimney nostrums like quack Medicines, are too often indiscriminately applied, and do the Patient more harm than good.

The most general cause of Smoke in in *well finished* Rooms, is their extreme closeness. Doors and Windows are now so nicely jointed, that an hurricane can
C scarcely

scarcely force a breath of air thro' them: and if the Wood by shrinking, suffers a little air to get thro'; with double Doors, Curtains, Sand-bags, Lifting, &c. we endeavour to prevent it.

If therefore the theory be true, *That it is the Air in the Room that forces, impels or drives the smoke up the chimney*, how can that be effected without a perpetual supply of air from without? To let air into the Room thro' a circulating Ventilator, sometimes moderates the unhappiness, but it is a noisy and unfightly medicine; and tho' it in some measure disperses the air thro' the room by its motion, yet the air still comes too much in a stream towards the fire thro' it, not to give stiff necks and colds to those who sit in the way of it. Sometimes a hole is made close above the Cornice over the door to let in the Air, so as the cornice may throw the Stream towards the top of the Room, and in *high* rooms this has a very good effect; but in *low* ones the hot air near the cieling will press out, and be
sometimes

sometimes more than a balance for the cold air that would press *in*. For in a low room heated by a large fire, let the door be opened, and every one knows that if a lighted candle be held near the *top* of the door-case, the flame will be blown *out* of the room by the *hot* air near the ceiling; but if the candle be held near the *bottom* of the door-case, the flame will be blown *into* the room, by the *cold* air rushing in towards the fire; for heated air is always lighter than cold air, and therefore rises (in a room with a hot fire in it) up to the ceiling. Hence the heat in the uppermost Gallery of a Play-house; the smell of roast meat at top of a stair-case communicating with the Kitchen; the rise of air heated by breathing, &c. This Medicine is but therefore seldom effectual: and if an opening be made more effectually at or near the *bottom* of the door, it gives uncomfortable coldness to the back and legs of those who sit by the fire. Sometimes air is let into close rooms under the Grate; so that by having such near access to the fire, (and

seemingly without coming thro' the room) it may force up the smoke without cooling the room, or giving cold to its inhabitants; but alas! all motion being rectilineal, the air rushes streight into the room, and drives the ashes about it, against those who sit by the fire; or makes a most disagreeable whistling noise. To set the door open seems therefore the only remedy, and thereby to expose the Family to a dangerous courant of cold air, and the lifting of servants. Nay, sometimes on opening the door, the *whole smoke* shall pour *streight* into the room! for if the door communicates with a passage that leads to a Kitchen, or a Room in which there is a *larger* and *hotter* fire, then will the air rush down your Chimney to restore an equilibrium with the hotter neighbouring rooms, and bring down all the smoke along with it.

What shall be done? has Doctor Philosophy with his Apothecary Mechanics no cure for this Malady?

A per-

A perpetual oozing of smoke under the Mantle-piece into the room is the disorder. Air properly administered is evidently the cure ; but applyed as above the cure is little better than the Disease. Air must come full in the face of the fire to drive up the smoke—coming sidewise it blows it into the room. *To make air rise from the Front of the fender obviates every objection—for it will give no cold to the room, or those who sit by the fire, and will rise to the fire in the most friendly of all directions to drive up the smoke.*

A hollow fender as fig. 2d, answers these ends ; 1st, two holes are made thro' the out Wall, *e e*, at the corners, under the Grate, of four inches and half high, and two inches and a quarter wide—the square tubes *m x*, are fastened into these holes, and plastered round to hide the cramps that fasten them to the wall *e e*, and prevent superfluous air coming in. The Fender itself is shaped as *o o g*, and made to slide upon the above square iron tubes *m x*, at *x x*. The holes *g* on the side of the fender

fender next the fire, should be about eight in Number, and three fourths of an inch in diameter, with a slide within the fender by which the holes may be contracted or shut at pleasure. The Fender being now slid upon $x x$, the air will rush through it, and rising thro' the holes g in the face of the fire, will drive the smoke up the chimney in the most friendly direction possible, and without giving cold, or offending any Person in the room; $r s$ is a profile or section of the Fender.

When the chimney is in an inner wall, or joins a neighbouring house, and cannot have holes thro' it, then a tin square pipe must come thro' the *out* wall, and behind the skirting-board of the room, as $m t$, fig. 2d, and the Fender $o o g$ must join it at x , and have the other end $e x$ stopt up. The skirting-board being then nailed as before, will hide the pipe and prevent its disfiguring the room.

If the Hearth of the smoking Chimney be over a cellar, the cure may be still better

ter concealed, and be full as effectual, by having an hole cut thro' the hearth-stone, just within the fender, of about four inches diamiter, as *z* fig. 2d. In this case a common fender will do; and to prevent coals or ashes from falling through, a cullender as *b* fig. 10th must be put in the hole, whose top must be full of holes, as *a*.— This Cullender may be made of tin, copper, or iron, and is hid from sight by the Fender. Thro' this Cullender the air will rise out of the cellar, and drive up the smoke without giving cold to any in the room.

These methods of cure for close rooms, tho' new, has had sufficient trial, and has not been found to fail. They have this peculiar advantage over the other methods, that even *indiscriminately applied*, they seldom fail of cure. They also *join* the methods used on the Top of chimnies to great advantage, particularly that of fig. 8th, fig. 5th, and fig. 11th.

Objections to this method would be, the
want

want of ventilation in the room; that the air would remain stagnate in it, that it must grow worse and worse by being breathed over and over again; by candles burning in it; by perspiration, &c. objections too well founded! for certainly the variety of Disorders in this age, so little known to our more hardy forefathers (who lived more abroad in the open air) take their rise from breathing stagnate, putrid, or phlogisticated air! The Lungs are the most delicate parts of our bodies, and nearly the most vital; tho' parts of them may be destroyed or rendered useless, without immediate death. Air therefore loaded with acrimonious and phlogistic particles, saturated with alkalescent perspiration, the acid of coals, or putrid effluvia from corrupting animal or vegetable substances, must be ill qualified to dissolve these matters in the lungs, and carry off what it has already in too great an abundance. But the ventilation of the room may still take place with this *fender*; for as there is a *slide* in it, by which the Air may be prevented from rising from it; when the fire
burns

burns clear, this slide should be flipt over the holes *g* fig. 2d, and then the air of the room will flow up the chimney, and may be entirely changed by letting open a window for a few minutes.

Were chimnies properly built at first, there would be little occasion for the above methods of cure. Their most common faults are, being too wide at bottom, or too narrow at top; being rough, and ill plastered within, so as to catch and lodge the soot; being too low, or at least lower than the neighbouring trees, houses, hills, &c.——turning too acute by the fire-places of upper stories; two or more flues going into one &c.—Fig. 1st is the section of a Stack which obviates these faults; saves Bricks; effectually insures a good draught; and prevents the effects of boiling downward, or eddy Winds. *aaa* is the flue of the ground Story; it is narrow just above the fire, then opens into a large belly at *a*; grows again narrow as it passes the second fire-place, and opens into another belly, from whence it grows gradually

D ly

ly narrow, and then widens to the top. The narrow places make the draught,—the *belly parts* allow eddy wind from the top to be condensed in them, and the wide part at top diverts horizontal or downward wind, by reverberating it from side to side and thereby retarding the career it would otherwise make down the chimney. The flues *b* & *c* are on the same principles; so the *shaded part* of the figure represents the chimnies, and the *white part* the brick-work. *o o* is the gable of the house; *r* the first, and *s* the second floor.

At first sight this Stack appears difficult to build; it is quite the reverse: The projection of the stack from the main wall is just the same as in common Stacks; the *bellying parts* are not *deeper* than the *narrow parts* of the chimney; the bellies are only wide *sidewise* or laterally; they do not project into the room as they appear in the figure, for the figure is a front view of the Section.

The flues should be a brick and an half
deep

deep in both the narrow and wide places, so as to admit a boy to sweep them; and if they are plastered smooth the lodgments of soot will be little more than in straight chimnies. It may be observed in the figure, that there are sufficient buttresses for the fire-places; and that the partitions between one flue and another are by no means difficult to build.

The two common causes of smoky chimnies are prevented in this stack, (*viz. the want of draught, and bosoming winds*) in a manner as simple, as easy of execution, and less expensive than the most common mode of building chimnies. Architects seem not to trouble their heads about this matter; what is within the walls is hid from their employers sight; Chimney-pieces must bear an established tho' arbitrary proportion to the size of the room! and it is infinitely of less importance that the family should be smoked into bacon, than the eye of criticism should suffer one moment; let me not attribute this to either ignorance or design; 'tis the want of attention to a subject

beneath the architect's notice; he will not make a bricklayer his enemy by putting him out of his way; and the readiest method of doing a thing, is generally the most profitable.



On VENTILATION.

A New Method of supplying Rooms with perpetual good Air.

CHIMNIES built in the above way bid defiance to any Wind, the draught being so great in the narrow parts, and admit of so much compressure in the wide parts.——But after all, could our rooms be ventilated by warm air in the winter and cold air in the summer, and this

so diffused thro' the rooms as neither to be
 offensive or dangerous, our habitations
 would certainly be more wholesome than
 they are known to be at present: It cannot
 too often or too forcibly be inculcated, how
 necessary to Health is the breathing of good
 air. When religious tyranny huddled its
 absurd votaries together near churches and
 monasteries; plagues, pestilences and fam-
 ine anounced the outrage unheard; 'twas the
 immediate finger of God, in the langu-
 age of ungrateful and ignorant fatalists:—
 Streets of projecting houses nearly meeting
 at top; rooms with small windows, never
 meant to open; and dirt in all its glory
 excluded every possible access of fresh air.
 It may seem strange that in this age of
 philosophy and enlarged sentiment, we
 should run into similar error; but so it is;
 tho' we have opened our streets, pulled
 down our signs, and made sewers for eve-
 ry thing that may contaminate the air; a
 Court can seduce the active and needy with
 its employments, the rich and idle with its
 pleasures, and all with its Luxuries, Dou-
 ceurs and Fashions. Hence all Capitals
 grow

grow too large ; all creep close to the attractive Center ; our minds lose their relish for simplicity and nature ; and even the Lungs accommodate themselves to a thick and putrid air, so as to be even offended by that of the Country. At certain periods of police and refinement, 'tis in vain to preach against this absurdity ; Fashion and Habit establish every thing : It remains but for the philosopher to *moderate* the evil if possible, by his researches.

It may also seem a little strange, that among the variety of new airs that have been discovered, and the surprizing properties they possess ; (nay that atmospheric air itself can really be made) that no one has yet turned his attention to *the cure of contaminated air in large towns* ; the progress I have been fortunate enough to make in this cure, is of too much importance to society to lie dormant, tho' the discovery is much in its infancy, and will, no doubt, receive many future improvements.

The air considered as a chemical men-
struum,

truum, absorbs with more or less affinity, every kind of matter it comes in contact with; from coal fires it receives Phlogiston an acid, and much earthy matter; from corrupting and putrid animal substances it receives phlogistic and alkalescent particles of a very noxious quality; from corrupting and fermenting vegetables, fixt air and phlogiston; and from the calcination of metals, and breathing, it receives Phlogiston.

Every human, nay every animal secretion loads the air with alkalescent particles. Bogs often throw up inflammable air into the general mass; and motion thickens the whole with dust. Such is the chaotic and heterogenous assemblage we breathe in large cities; and from the immense variety of disorders that originate in the Lungs, 'tis easy to judge how pernicious such air must be to them.

We can filter muddy water; separate salt and other matter from it, and why not do the same with air?

In

In proportion to the quantity of *nitrous air* * that any *common* air will absorb, in the same proportion Doctor *Priestley* has proved it fit for respiration; agreeable to this criterion, we find air grow better all the way up mountains, and worse the higher we ascend in large towns. By repeated trials in many parts of *London*, I find it better by *one fourth* near the street than on the tops of the Houses; evidently shewing, that if the air be derived from the earth (as the same ingenious Gentleman I think has very satisfactorily proved) that it becomes more and more saturated with noxious particles to a certain height in all close towns. Could we therefore bring the air even in its natural state from the surface of the ground into our apartments, it would be much better than that we generally breathe: But the cure would be still more effectual, if in its passage we could let it go through such substances as would
neutralize

* Nitrous air arises from the effervescence of copper filings, with diluted spirit of nitre.

neutralize or absorb its bad qualities. These substances I have discovered; and they are cheap, common, and lasting; the tin pipes which convey the air, will be the principal expence.

Suppose *A* (fig. 1st, plate 2d) represents the section of a kitchen; *B* of a room over it; *D* the fire and chimney. *E* is a square box of wood filled near full of the purifying matter, having its bottom full of small holes to let the air through; near its top and above the ingredients fix a tin square pipe *a* in a hole in the box very tight, and let the box stand in a clean part of the yard, and if there are bushes growing round and over it so much the better. The pipe (*a*) passes thro' the out-wall of the House (*o*) and forward by the inside of the kitchen wall to the wall of the chimney, (*s*) thro' which it passes into the inside of the chimney, and ascends up one corner of it to the Garrets; where the ventilator *F* receives or draws the air up the pipe as occasion requires.

E

Now

Now suppose the room *B* is to be ventilated; the open pipe *q* must be shut, (as it communicates with the principal pipe *a*) and the pipe *a* must likewise be shut at *n* by the valve *a* fig. 3d.—the air will then pass into and along the pipe *g*, which pipe goes behind the skirting-board of the room, as *a a a* fig. 2d, and along two sides of it; this pipe has a number of small holes of a quarter of an inch diameter bored into it, as at *c c*, out of which the good air rises perpendicularly into the room; and after passing a-cross the room, enters the main or chimney-pipe at *r* near the ceiling of the room.

But if I want to ventilate the kitchen *A*, a pipe like *a a a* fig. 2d. must go round the bottom of the kitchen and let in air as above, which will cross the room and enter the main pipe at *q*, sweeping away every disagreeable effluvium along with it.

If a parlour be on the same floor with the kitchen, the pipe (*a*) must cross both walls of the chimney, and pass behind the skirting-boards of the parlour at *c*, and re-
turn

turn to the main pipe thro' z , which joins g round the outside of the chimney in the kitchen A .

This chimney pipe gives *warm* air to the rooms; but if *cool* air be required, a pipe communicating with a at x , on the outside of the house, goes thro' the out-wall at v and joins the pipe g . This is a summer pipe, and (a) is a winter pipe.

If B be a Drawing-room in the time of much company, either x or a may open into it, and a boy working the ventilator F will accelerate the rise of the hot phlogisticated air at r , and a perpetual supply of cool and fresh air will rise through $c c c$ fig. 2d, and refresh without giving cold to the company.

The conveniencies arising from this invention, are, 1st, The room is made warm or cool at pleasure. 2d, Its air is perpetually changing without a current, or being liable to give its inhabitants cold. 3d, The air that comes in is pure as mountain air,

and free from all smell. 4th. If the chimney of the room be liable to smoke, 'tis cured by the perpetual influx of good air. 5th, But the room has no occasion for fire even in the depth of winter, the air receives so much heat from the kitchen chimney, in which the pipe of conveyance is fixed. 6th, Air hurt by breathing or burning candles, ascends to the cieling, and thence up the pipe of conveyance to the top of the house, by the influence of the kitchen fire; for *heated air always ascends*. 7th, Sick-rooms, Hospitals, Jails, Play-houses, Lecture-rooms, or Ships, may be ventilated by the same means. 8th, An iron rod *a F w* joining the pipe *a* (fig. 1st,) and reaching a few feet above the chimney top, makes the pipe into a good *Conductor of Lightning*, if a thick wire *x y* stick two or three feet into the Ground.

The whole operation may be stopt in a moment by shutting the valve (*a*) fig. 3d. that lets the air into the room, or by shutting (as with a snuff-box lid) the opening *r*, fig. 1st.

The

The valve, fig. 3d, turns by the handle *b*, which when pressed down, *a* rises, and shuts the opening *g*; but when it is turned up, it shuts the tube *n*, and opens *g*. The pipes are square, and the valve *a* shuts close to the foldered wire *s*. This valve must have room at *d*, fig. 1st, left in the wall, that the hand may get easily to turn it; but the orifice in the chimney must be well plastered up for fear smoke get thro'.

A better and more universal valve or cock is fig. VI. It is a half cylinder, (*a b c*) of the same length as the depth of the pipes, and has a circle of tin foldered to its top and bottom, on which is foldered the handle or index (*o b*).—In the plate it points to the word *warm* (engraven on the tin pipe)—for the air (as may be seen) would come along the pipe marked *Shut*, and turn along the pipe marked *warm*.—But when the Index is turned so as to point to the word *cool*—the pipe marked *cool* (coming from without) opens into the pipe marked *warm*, &c.——So that by turning the index to the respective words; warm, cool,

cool, or no air at all, can be let into the room at pleasure.

The ventilator is placed in the garret—and is only used when any room wants *extraordinary* ventilation—the circulation goes on in general by the heat of the kitchen chimney—but when a room has much company, many candles burning, or any person sick in it; a Boy, with ease, will change the whole air of the room in an hour, by working the ventilator.—A Section of this simple instrument is given, fig. 4th—its base is a board three feet long and one broad—to the edges of which are nailed two boards cut as *a b*—on the top of which is nailed down the thin board *c d*, three feet three inches long, and one foot broad.—Perpendicular to this stands the triangle *e f g* of two boards, each two feet nine inches long and one foot broad, ending in an edge at *g*;—two holes of two inches diameter are bored through these at *h* and *i*.—From the place where the two boards meet (viz. at *k*) hangs a wire that sustains the strong round leathern valves

h i

h i, which stand open when the instrument is *not* in use, but shut alternately when it is. —On the edge *g* hangs the triangular box *m n g*, (represented by pop lines) with two valves, *o* and *p*, of two inches each in diameter.—This box is shut every way, except at these valves and at the bottom *m n*; being one foot wide, and made to fit the curve *c d* so near, that little air may escape when by the handle near *h* it is swung backwards and forwards to excite a constant draught of air up the main pipe *a* fig. 1st.—As *m n* moves towards *c* fig. 4th, a vacuum is made in the space *k h*; for the valve *o* shuts, and the valve *h* opens; so that the air from the main pipe rushes between *e* and *f*, and pushes open the valve *h*.—As the triangular box *m n* moves towards *d*, the air in the space *k h* pushes open the valve *o*, and escapes; whilst the valve *h* shuts, the valve *i* opens, with *p* shut; so that the same effect is produced on the other side of the upright triangle, and of course a perpetual draught kept up. —A perspective view of the movable part of the ventilator is fig. 5th—*h h* the two valves—*d* the handle. Any

Any number of rooms may be ventilated by these pipes and ventilator—but most conveniently if they are one above another, and adjoining to the kitchen chimney—the box containing the purifying ingredients may be about a foot square, and the pipes about three inches square.—The Doors and windows should be close shut when the *good* air is particularly wanted—and a fire-board placed in the chimney-piece when *cool* air is wanted.

Fig. 7th is a short Mast and a Sail, to be fixed on the top of that part of the Ventilator fig. 5th by its forked bottom *a b*, and to be of a proportional size to the Ventilator, as in the two figures in the plate.—This is for the Ventilator when used on shipboard, or any where that it can be turned to the wind.—The Pole *c* turns by two rings (*o o*) round the mast; and to this pole are fastened by stiff supporters *n n*, the Yards that support the sail.—Now as the motion of the wind is by intervals greater and less, it affects the sail so as to make the mast nod, or rise and fall;—a motion

and fall,—a motion that will actuate the Ventilator the same as by hand.

A round wooden tube going through any convenient part of the Deck, having a leathern tube of three inches diameter tied to it, that will reach into any part of the ship, is all the apparatus necessary (with the ventilator) to keep the ship free from the pernicious effluvia of pitch, bilge water, damp cloathing, breath, candles, &c. a piece of œconomy of the last importance to the health of seamen; and it is remarkable, that by an attention to this, fewer men died in the late voyages round the world, than frequently do in crossing the Atlantic.

By this time the Reader's curiosity is excited to know what the ingredients of purification are in the square box without doors. So far I can inform him, that they are principally what nature uses for the same purpose, the vegetable world excepted; for vegetables are of too perishable a nature to be admitted amongst the ingredients: Plants growing round the box will be of
F use

use, if their leaves be duly swept away in the autumn. As to the ingredients they will want changing every four or six months; but they are too cheap to be objects of objection with any one; and I hope the world will not think me churlish in concealing this part, or in the measures now taking to secure an exclusive right in the disposal of them.

This box may be removed at pleasure, and boxes of roses, aromatics, perfumes, &c. put in its place. Even boxes of growing or fresh vegetables may be put, for the air to pass through occasionally, as they are known to absorb, and even derive nutrition from the putrid, phlogestic, or mephitic airs, and to deprive those airs of their pernicious qualities.

It becomes not me to say more; the influence of air upon health and spirits is sufficiently known. It is enough to observe, that the contrivance will not injure or incumber the House; that the pipes will be the chief expence, and that not above 6d. a
foot

foot, and that the whole effect will be concealed — that working the ventilator or changing the ventilation from one room to another, may be taught a servant at sight.

FINIS



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Part of the 2nd of the following
to the 1st of the following
to the 1st of the following
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Brown



